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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Paper No. 20030801

Application Number: 09/826,422
Filing Date: April 05, 2001
Appellant(s): MASLOV ET AL.

Maslov et al.
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed 2/21/2003.

(1) R al Party in Interest

A statement identifying the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

A statement identifying the related appeals and interferences which will directly affect or be directly affected by or have a bearing on the decision in the pending appeal is contained in the brief.

(3) Status of Claims

The statement of the status of the claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Invention

The summary of invention contained in the brief is correct. However, " Gaps between magnets provide a longer flux path in the rotor back iron. As the gaps are uniform, the overall flux distribution in the back iron along the circumferential path forms a repeated arch-like pattern. This pattern effects an improved uniform distribution of magnetic potential difference of the magnet surfaces at the air gap" in page 4 is a new matter that was not described in the specification.

6) Issues

The appellant's statement of the issues in the brief is correct.

(7) Grouping of Claims

Appellant's brief includes a statement that claims 4,6,13-16, group of claims (1,3,5 and 11) and group of claims (2 and 12) do not stand or fall together and provides reasons as set forth in 37 CFR 1.192(c)(7) and (c)(8).

(8) Claims Appealed

The copy of the appealed claims contained in the Appendix to the brief is correct.

(9) Prior Art of Record

4,754,207	Heidelberg et al.	6-1988
6,181,305	Acquaviva	1-2001
6,278,216	Li	8-2001
5,015,903	Hancock et al.	5-1991
5,918,360	Forbes et al.	6-1999

(10) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claim 1,3,5-6 and 11 are rejected under 35 U.S.C. 103(a) as being anticipated by Heidelberg et al. in view of Acquaviva.

Regarding claim 1, Heidelberg et al. show a rotary permanent magnet electric motor comprising:

* a stator configured in the form of an annular ring having a plurality of groups of electromagnet poles (abstract), the groups substantially equidistantly distributed along the angular extent of the annular ring (Fig. 1 and Col. 4, lines 50-56), each of the groups

comprising magnetic material magnetically isolated and separated from the other groups (Col. 2, lines 20-25); the electromagnet poles having pole faces separated from each other by gaps, gaps between pole faces within each group being of a substantially uniform first angular distance (gap between magnetic poles of stator core); and an annular rotor (4 in Fig. 1), concentric with an axis of rotation and concentric with the annular stator to form a radial air gap therebetween, comprising a plurality of permanent magnets (8) substantially equidistantly distributed with alternating magnetic polarity along the angular extent of the air gap, the permanent magnets having a common magnetic return path (20); wherein each group of electromagnet poles comprises windings that are switchably energized for driving electromotive interaction between the stator and rotor (Col. 2, lines 25-30).

The structure disclosed by Heidelberg et al. does not show:

* the permanent magnets of the rotor are separated from each other by gaps of a second angular distance different from the first angular distance (gap between magnetic poles of stator core).

Acquaviva shows a rotary permanent magnet electric motor wherein the plurality of permanent magnets of the rotor are uniformly separated from each other by gaps (S in Fig. 3) of a second angular distance different from the first angular distance (gaps 15 between stator poles as described in Col. 5, lines 30-45 and in abstract) for the purpose of reducing cogging torque (Abstract).

Since Heidelberg et al. and Accquaviva are in the same field of endeavor, the purpose disclosed by Accquaviva would have been recognized in the pertinent art of Heidelberg et al.

It would have been obvious at the time the invention was made to a person having an ordinary skill in the art to modify Heidelberg et al. by reducing the angular length of the permanent magnets (8) to create gaps of a second angular distance different from the first angular distance (gaps between stator poles) as taught by Acquaviva for the purpose of reducing cogging torque.

Regarding claim 6, Heidelberg et al. also disclose an embodiment wherein the angular distance of the gaps between adjacent poles of adjacent stator groups (40 in Fig. 3) is different from the angular distance of the gaps (38) between adjacent permanent magnet poles of the rotor (4).

Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Heidelberg et al. in view of Acquaviva and further in view of Li.

Regarding claim 4, Heidelberg et al. and Acquaviva show all limitations of the claimed invention except showing a rotary electric motor wherein said position sensor comprises a resolver; and said motor further comprises an encoder for generating said signals.

However, Li discloses a rotary electric motor wherein said position sensor comprises a resolver; and said motor further comprises an encoder for generating said signals (claim 6 and 7) for the purpose of detecting the position of rotor.

Since Heidelberg et al., Acquaviva and Li are in the same field of endeavor, the purpose disclosed by Li would have been recognized in the pertinent art of Heidelberg et al. and Acquaviva

It would have been obvious at the time the invention was made to a person having an ordinary skill in the art to modify Heidelberg et al. and Acquaviva by using a resolver and an encoder in the rotary electric machine as taught by Li for the purpose of detecting the position of rotor.

Claims 2,12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Heidelberg et al. in view of Acquaviva and further in view of Hancock et al.

Regarding claim 2, the structure disclosed by Heidelberg et al., modified by Acquaviva show all limitations of the claimed invention except showing a rotary electric motor wherein each stator group comprises no more than a single pair of poles, each pole having a winding configured to form a magnetic polarity opposite to the magnetic polarity of the other pole of the pair, wherein switched energization of the pole pair winding effects reversal of the magnetic polarities of the pole pair.

However, Hancock et al. disclose a rotary electric motor wherein each stator group comprises no more than a single pair of poles, each pole having a winding configured to form a magnetic polarity opposite to the magnetic polarity of the other pole of the pair, wherein switched energization of the pole pair winding effects reversal of the magnetic polarities of the pole pair (Fig. 9a and 9b) for the purpose of preventing flux reversal and high switching frequencies in motor (Abstract, lines 20-24).

Since Heidelberg et al., Acquaviva and Hancock et al. are in the same field of endeavor, the purpose disclosed by Hancock et al. would have been recognized in the pertinent art of Heidelberg et al. and Acquaviva.

It would have been obvious at the time the invention was made to a person having an ordinary skill in the art to modify Heidelberg et al. and Acquaviva by forming stator groups comprising a single pair of pole as taught by Hancock et a. for the purpose of preventing flux reversal and high switching frequencies in motor.

Regarding claim 12, the structure disclosed by Heidelberg et al., modified by Acquaviva shows a rotary electric motor wherein the number of stator group is an odd number (5) but fail to show the number of poles within each group is an even number.

It would have been obvious at the time the invention was made to a person having an ordinary skill in the art to modify Heidelberg et al. and Acquaviva by forming stator groups comprising a single pair of pole (even number of poles) as taught by Hancock et al. for the purpose of preventing flux reversal and high switching frequencies in motor.

Claims 13-15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Heidelberg et al. in view of Acquaviva and further in view of Forbes et al.

Regarding claim 13, the structure disclosed by Heidelberg et al., modified by Acquaviva shows all limitations of the claimed invention except showing a rotary electric motor wherein each stator group is individually secured to a non-magnetically permeable support structure, thereby facilitating independent removal and replacement of an individual stator group.

However, Forbes et al. disclose a rotary electric motor wherein each stator core is individually secured to a non-magnetically permeable structure (Fig. 24 and Col. 17, lines 40-45) and The Examiner interprets aluminum as a non-magnetically permeable material), thereby facilitating independent removal and replacement of an individual stator core (Fig. 16) for the purpose simplifying the maintenance of the motor.

Since Heidelberg et al., Acquaviva and Forbes et al. are in the same field of endeavor, the purpose disclosed by Forbes et al. would have been recognized in the pertinent art of Heidelberg et al. and Acquaviva.

It would have been obvious at the time the invention was made to a person having an ordinary skill in the art to modify Heidelberg et al. and Acquaviva by forming individual pole pair groups and secure them to a non-magnetically structure as taught by Forbes et al. for the purpose of simplifying the maintenance of the motor.

Regarding claim 14, Forbes et al. also disclose a rotary electric motor wherein said motor further comprises: a plate member (281 in Fig. 24); and a shaft member (255) located at the axis of rotation wherein each-of said stator cores is secured to said plate member at a spaced radial distance from the axis of rotation; and said plate member is attached to said shaft member (by bearing means 257 Fig. 24) for the purpose of simplifying the maintenance of the motor.

It would have been obvious at the time the invention was made to a person having an ordinary skill in the art to modify Heidelberg et al. and Acquaviva by forming individual pole pair groups and secure them to the plate member at a spaced radial

distance from the axis of rotation and secure the plate member to the shaft as taught by Forbes et al. for the purpose of simplifying the maintenance of the motor.

Regarding claim 15, it is noted that Heidelberg et al. also show a rotary electric motor as wherein said spaced radial distance is greater than the radial distance between inner and outer boundary diameters of the stator annular ring.

Claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over Heidelberg et al. and Acquaviva in view of Forbes et al. and further in view of Li.

Regarding claim 16, Heidelberg et al., Acquaviva and Forbes et al. show all limitations of the claimed invention except showing a rotary electric motor wherein said motor further comprises a rotor housing, the rotor annular rotor being mounted within the housing at a spaced radial distance from the axis of rotation, and the rotor housing is journalled for rotation about the shaft through bearings.

However, Li discloses a rotary electric motor wherein said motor further comprises a rotor housing (11' in Fig. 1), the rotor annular rotor being mounted within the housing at a spaced radial distance from the axis of rotation, and the rotor housing is journalled for rotation about the shaft through bearings (74') for the purpose of mounting the rotor directly to the wheel of a bicycle.

Since Heidelberg et al., Acquaviva, Forbes et al. and Li are in the same field of endeavor, the purpose disclosed by Li would have been recognized in the pertinent art of Heidelberg et al., Acquaviva and Forbes et al.

It would have been obvious at the time the invention was made to a person having an ordinary skill in the art to modify Heidelberg et al., Acquaviva and Forbes et

al. by including a rotor housing, the rotor annular rotor being mounted within the housing at a spaced radial distance from the axis of rotation, and the rotor housing is journalled for rotation about the shaft through bearings as taught by Li for the purpose of mounting the rotor directly to the wheel of a vehicle.

(11) Response to Argument

Regarding claim 1, Appellant's argument is on the ground that "each reference to serve a different objective... It is submitted that a person of ordinary skill in the art, simply because the two references are categorized as "being in the same [undefined] field of endeavor," would not have been led to modify Heidelberg in order to obtain therein reduced cogging torque benefits achieved in the Acquaviva configuration" and "the prior art as a whole teaches away from the modification proposed in the Office Action" are not found persuasive because permanent magnet motor is not a very large field of endeavor and an artisan always wants to improve the motor efficiency. It is noted that Accquaviva shows the motivation of spacing the permanent magnets apart is "to provide a desired distribution for the density of magnetic store in the air gap"(abstract), therefore, cogging torque is reduced and torque efficiency is improved. To those skilled in the art, the motor disclosed by Heidelberg et al. and the motor of Accquaviva are the same kind of permanent magnet motor and they both have permanents magnets concentric with the electromagnet stator poles (col. 1, lines 50-55).

Because there is a clear cut teaching about the desirability of the modification, it would have been obvious at the time the invention was made to a person having an

ordinary skill in the art to modify Heidelberg et al. by spacing magnets apart for the purpose of improving motor efficiency.

Regarding claim 6, Heidelberg et al. show another embodiment in Fig. 3 wherein the permanent magnets of the rotor can be separated by the gaps different from the gaps between adjacent poles of adjacent stator group. Moreover, Accquaviva discloses a structure wherein the permanent magnets are spaced apart by the gaps for the purpose of optimizing the maximum torque.

It would have been obvious at the time the invention was made to a person having an ordinary skill in the art to modify the structure of Heidelberg et al. in Fig. 1 by spacing the permanent magnets apart by the gaps different from the gaps between adjacent poles of adjacent stator group as taught by Accquaviva for the purpose of optimizing the maximum torque.

In response to Appellant's argument regarding claim 4, it is noted that Heidelberg discloses the to locate Hall sensor at one or more of the locations between adjacent stator group to detect the position of the rotor so that the operation of the motor can be controlled (Col. 4, lines 56-68 to Col. 5, lines 1-14). Li teaches the equivalent of using a resolver or encoder and using Hall sensor for the purpose of detecting the rotor position (Col. 5, lines 24-29). It would have been obvious at the time the invention was made to a person having an ordinary skill in the art to modify the structure of Heidelberg et al. by using a resolver and encoder instead of Hall element as taught by Li to detect rotor position.

In response to Appellant's argument regarding claims 2 and 12, it is noted that the motivation Hancock et al. to make pairs of magnetic isolated stator pole is described in the abstract: the motor operate without the reversal of flux in the stator (or flux transformer effect) to achieve high efficiency motor and Hancock disclose in Fig. 9a the stator group comprises no more than a single pair of poles, each poles having a winding configured when energized to form a magnetic polarity opposite to the magnetic polarity of the other pole of the pair. Even though the rotor structure of Hancock et al. is different from the rotor structure of Heidelberg et al. and Accquaviva (because Hancock et al. do not use permanent magnet), they all operated by the flux interaction between the stator and the rotor. Because there is a clear cut teaching about the desirability of the modification, it would have been obvious at the time the invention was made to a person having an ordinary skill in the art to modify Heidelberg et al. and Accquaviva by making pairs of magnetic isolated stator pole for the purpose of improving motor efficiency.

In response to Appellant's argument regarding claims 13 and 14, it is noted that Forbes et al. disclose in Col. 17, lines 40-45, the non-magnetic support structure (the Examiner interprets aluminum as a non-magnetic material) to mount the stator pole sections and it is inherent that the stator pole sections can be removed and replaced independently (as shown in Fig. 16) for the purpose simplifying the maintenance of the motor.

Regarding claim 14, it is noted that the plate member is not only a heat-sink device but it is also a support structure for the stator component as described in col. 17, lines 30-35.

In response to Appellant's argument regarding claim 15, even the written description of Heidelberg et al. does not disclose the spaced distance is greater than the radial distance between inner and outer boundary diameters of the stator annular ring, the drawing (Fig. 1) already implies the intention of the inventors. Forbes et al. also disclose the requirement as shown in Fig. 1 but not in written description, and it is hard to say that the spaced distance could be equal or smaller than the radial distance.

In response to Appellant's argument regarding claim 16, there is no evidence that Heisenberg et al. and Accquaviva disclose arrangement wherein the rotor is mounted to the shaft and the structure being rotatable. Indeed, the structure disclosed by Heidelberg et al., Acquaviva and Forbes et al. is very similar to the structure of the present invention with the outside rotatable rotor and it is obvious for one skilled in the art to mount the rotor housing to the rotor and the rotor housing is journalled for rotation about the shaft through bearing as clearly taught by Li (Fig .1).

For the above reasons, it is believed that the rejection should be sustained.

Respectfully submitted.

Nguyen Hanh Nguyen

Hanh Nguyen Nguyen

August 25, 2003

Appeal Conference held on August 27, 2003

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